

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

UNDERGROUND OUTLET

(Ft)

CODE 620

DEFINITION

A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

PURPOSE

Dispose of excess water from terraces, diversions, subsurface drains, surface drains, trickle tubes or principal spillways from dams (outside the dam area only), surface irrigation tailwater or other concentrations without causing damage by erosion or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) excess surface water needs to be disposed of; (2) a buried outlet is needed for Diversions (362), Terraces (600), Water and Sediment Control Basins (638), Sediment Basins (350), Grade Stabilization Structures (410) or similar practices; (3) a buried outlet is needed for the disposal of irrigation tailwater from a field with a convex end condition or the slope of the drain ditch an erosive grade; (4) an underground outlet can be installed that will safely dispose of excess water; and (5) surface outlets are impractical because of stability problems, climatic conditions, land use, or equipment traffic.

This standard does not apply to trickle tubes or to principal spillways through pond embankments or to subsurface drains.

CRITERIA

All planned work shall comply with all Federal, State, and local laws and regulations.

Capacity. The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace, diversion or other practices function according to the standard for the specific practice. For example, an underground outlet can be used in combination with a grassed waterway or a surface drain to carry part of the design flow. The capacity of the underground outlet for natural basins shall be adequate for the intended purpose without causing excessive damage to crops, vegetation, or improvements.

The discharge capacity of underground outlets for level terraces and water and sediment basins when combined with the storage capacity of the component facility, shall be such that the runoff from a 10-year frequency 24-hour storm will not overtop the specific terrace or basin. The release time for the stored water should not exceed 48 hours.

Underground outlets for waterways, diversions, gradient terraces and other channels shall as a minimum, convey the peak discharge for a 10-year frequency 24-hour storm. Underground outlets installed in combination with waterways and open channels shall be sized to convey no less

than the expected long duration flows and should be sized to convey the peak discharge from a 2-year frequency 24-hour storm.

Underground outlets installed to remove irrigation tailwater shall be sized to convey the larger of 1/4 the maximum field irrigation stream or the flow required to remove the volume of water from a 10-year frequency 24-hour storm within 24 hours.

Inlet. An inlet can be a collection box, a perforated riser, or other appropriate device. Its capacity shall be adequate to provide the maximum design flow in the conduit. Flow-control devices shall be installed as necessary. Perforated risers must be of durable material, structurally sound and resistant to damage by rodents or other animals. If burning of vegetation is likely to create a fire hazard, the inlet shall be fire resistant. Riser inlets shall be sized using applicable weir or orifice formulas; however, the riser shall be not less than 6-inch diameter. Collection boxes must be large enough to facilitate maintenance and cleaning operations. The inlet must have an appropriate trash guard to insure that trash or other debris entering the inlet passes through the conduit without plugging. It must also have an animal guard to prevent the entry of rodents or other animals.

Blind inlets can be used where they are effective. The use of gravel inlets is limited to level terraces and water and sediment control basins storing the 10-year frequency runoff and to sites where open structures will severely hamper normal farming operations. The minimum surface area for gravel inlets shall be 3 feet by 5 feet. When the volume of water to be discharged per 48 hours exceeds 30,000 cubic feet, the gravel surface shall be increased at least 5 square feet for each additional 10,000 cubic feet of water to be discharged.

Table 1 - PIPE LENGTH

Area of Slots Per Linear Foot of Pipe	Rectangular Slots	Round Slots
1 inch ²	5 Ft	10 Ft
2 inch ²	2.5 Ft	5 Ft
3 inch ²		3.5 Ft

The minimum length of perforated pipe within the gravel filter for each 0.1 cfs of required pipeline capacity shall be as shown in Table 1. In lieu of using this criteria the size of the gravel filter can be designed using Darcy's equation and the pipe length designed using criteria in Appendix A of NRCS, Soil Mechanics Note 3.

Gravel for the inlets shall be in the range of 1/4 inch to one-inch diameter. Gravel meeting the gradation requirements of ASTM C33 for designations 3, 357, 4 and 5 is acceptable.

On irrigation tailwater underground outlets, the individual risers can be designed for a portion of the total system design capacity. The individual riser design flow will depend upon riser spacing. Riser spacing shall be based on the sideslope of the field as follows:

<u>Slope</u> %	<u>Maximum Riser Spacing</u> Feet
1-<3	50-60
3 and greater	30-40

Small embankments shall be constructed between the risers to provide basins for ponding and sediment accumulation. The embankment height shall be a minimum of 6 inches above the design water height of the basin. The design water height is defined as the water surface height with the riser pipe flowing at design capacity. Embankments

shall have a minimum 2-foot top width at the design water height elevation and sideslopes of 2 to 1 or flatter.

Conduits. Underground outlets shall be continuous conduits, tubing, or tile. Joints shall be hydraulically smooth and of materials and type consistent with recommendations of the pipe manufacturer. If a pressure system is used, joints shall be adequate to withstand the design pressure, including surges and vacuum. On non-pressurized lines pressure-relief wells/open stand structures shall be designed and installed as needed to control pressure. If junction boxes and other structures are needed, they shall be designed and installed in a manner that facilitates cleaning and other maintenance activities.

The maximum velocity must not exceed the safe velocity for the conduit materials, joints and installation. Outlet pipelines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Capacity shall be based on the pipe size or on other flow control devices to prevent water from the upper inlets from discharging through the lower inlets. The minimum conduit diameter shall be 3 inches.

Materials. Materials shall meet or exceed the design requirements for internal pressure or vacuum and external loading without leakage. Plastic, concrete, aluminum, and steel shall meet the requirements specified in the applicable ASTM standard. Nonperforated pipe materials specified in Practice Standard, Subsurface Drains (606) can be used for underground outlets.

Grade. Positive grade shall be maintained in all sections of the conduit. In areas where sedimentation is a hazard, the minimum pipeline grade shall be 0.003 foot per foot.

The pipeline grade will be such that the design hydraulic grade line is below the top of any open risers.

Depth. Depth of cover shall be a minimum of 2 feet, however less depth of cover may be allowed for short distances at the outlet when necessary to provide adequate outlet conditions. Consider the depth of tillage and surface loads as applicable.

Outlet. The outlet shall be sufficiently stable for all anticipated flow conditions. It shall be designed for the maximum anticipated water surface at design flow. A continuous section of closed conduit or a headwall can be used at the outlet. If a closed conduit is used, it shall be durable and strong enough to withstand all anticipated loads, including those caused by ice. If fire is a hazard, the outlet shall be fire resistant. All outlets near ponds, outlet channels, or streams where water is normally present must have animal guards to prevent the entry of rodents or other animals. Animal guards must be hinged to allow passage of debris.

Protection. All exposed plastic materials shall be protected from degradation due to exposure to sunlight. All disturbed area shall be shaped and graded so that they blend in with the surrounding land features and conditions. Visual resources must be given the same consideration as other design features. Areas that are not farmed or covered by structural works shall be established to vegetation or otherwise protected from erosion.

CONSIDERATIONS

Consider effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

Consider effects on the volume of downstream flow that might cause undesirable environmental, social, or economic effects.

Evaluate potential use for water management.

Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by runoff.

Consider effects on the visual quality of downstream water resources.

Consider construction related effects on the quality of downstream watercourses.

Consider effects on wetlands or water-related wildlife habitats.

Consider the effects of impacts due to water quality due to agri-chemicals in outflow.

PLANS AND SPECIFICATIONS

Plans and specifications for installing underground outlets shall show the layout, pipe material and size, details for inlets and outlets, pipe trench and pipe backfill requirements and pipe appurtenances or other structures as needed for installing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Underground outlets shall be maintained by keeping inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce the flow. All leaks shall be repaired promptly to insure proper functioning of the conduit. Animal guards must be inspected periodically and maintained in proper working order. Maintain cover over the top of the pipe.

REFERENCES

- Engineering Field Manual
Chapter 2, Estimating Runoff
Chapter 3, Hydraulics
Chapter 15, Irrigation
- NRCS Conservation Practices
Structure for Water Control, Code 587
Irrigation System, Surface and Subsurface, Code 443
Subsurface Drain, Code 606